CLAIMS

1. A method for amplifying an optical signal having frequency in a signal frequency range, comprising
   - introducing said optical signal respectively into at least a first (11) and a second optical paths (12) disposed in series with each other, each comprising a Raman-active material having a predetermined Raman shift;
   - introducing into said first optical path (11) a first pump portion, said first pump portion including a first group of pump frequencies between a first minimum pump frequency and a first maximum pump frequency;
   - introducing into said second optical path (12) a second pump portion, said second pump portion including a second group of pump frequencies between a second minimum pump frequency and a second maximum pump frequency, a whole of said first and second group of frequencies extending over a pump frequency range having a width of at least the 40% of said Raman shift;

   characterized in that
   - at least a portion of said first group of frequencies is not included in said second group of frequencies and at least a portion of said second group of frequencies is not included in said first group of frequencies;
   - said steps of introducing said first and second pump portions into said first and second optical paths are performed such that a residual of said second pump portion entering into said first optical path has a power lower by 10 dB than said first pump portion, and such that a residual of said first pump portion entering into said second optical path has a power lower by 10 dB than said second pump portion;
   - said first minimum pump frequency and said first maximum pump frequency differ with each other of at most the 70% of said Raman shift; and
   - said second minimum pump frequency and said second maximum pump frequency differ with each other of at most the 70% of said Raman shift.

2. A method according to claim 1, characterized in that said steps of introducing said first and second pump portions into said first and second optical paths are

performed such that a residual of said second pump portion entering into said first optical path has a power lower by 13 dB than said first pump portion, and such that a residual of said first pump portion entering into said second optical path has a power lower by 13 dB than said second pump portion.

3. A method according to claim 1 or 2, characterized in that said first minimum pump frequency and said first maximum pump frequency differ with each other of at most the 50% of said Raman shift, and said second minimum pump frequency and said second maximum pump frequency differ with each other of at most the 50% of said Raman shift.

4. A method according to any one of claims 1 to 3, characterized in that said pump frequency range has a width of at least the 50% of said Raman shift.

5. A method according to any one of claims 1 to 4, characterized in that said first and second group of frequencies do not overlap with each other.

6. A method according to any one of claims 1 to 5, said first minimum and said first maximum pump frequencies defining a first pump frequency range and said second minimum and said second maximum pump frequencies defining a second pump frequency range, characterized in that at least one of said first and second pump frequency ranges has a width of at least the 20% of said Raman shift.

7. A method according to any one of claims 1 to 6, characterized in that said first group of frequencies is adapted for Raman amplifying a first portion of said optical signal, said second group of frequencies is adapted for Raman amplifying a second portion of said optical signal, the first portion of optical signal having a greater attenuation versus wavelength in said Raman-active material than said second portion of optical signal.

8. A method according to any one of claims 1 to 7, characterized in that it further comprises a step of providing said first and said second pump portions by a plurality of pump lasers, said plurality of pump lasers having an overall

variation of pump power emission of at most the 50% of an average pump power emission.

9. A Raman amplifier (10) adapted for amplifying an optical signal having frequency in a signal frequency range comprising at least a first (11, 21) and a second (12, 22) optical paths disposed in series with each other, each comprising a Raman-active material having a predetermined Raman shift, said amplifier (10) comprising:
   - a first pump source (13) connected to said first optical path (11, 21), said first pump source (13) being adapted for emitting and coupling into said first optical path (11, 21) a first pump radiation including a first group of pump frequencies between a first minimum pump frequency and a first maximum pump frequency;
   - a second pump source (14) connected to said second optical path (12, 22), said second pump source (14) being adapted for emitting and coupling into said second optical path (12, 22) a second pump radiation including a second group of pump frequencies between a second minimum pump frequency and a second maximum pump frequency, a whole of said first and second group of frequencies extending over a pump frequency range having a width of at least the 40% of said Raman shift;

   characterized in that
   - at least a portion of said first group of frequencies is not included in said second group of frequencies and at least a portion of said second group of frequencies is not included in said first group of frequencies;
   - the couplings between said first and second pump sources and said first and second optical paths are such that a residual of said second pump radiation coupled into said first optical path has a power lower by 10 dB than said first pump radiation, and such that a residual of said first pump radiation coupled into said second optical path has a power lower by 10 dB than said second pump radiation; and
   - said first minimum pump frequency and said first maximum pump frequency differ with each other of at most the 70% of said Raman shift; and

– said second minimum pump frequency and said second maximum pump frequency differ with each other of at most the 70% of said Raman shift.

10. A Raman amplifier (10) according to claim 9, characterized in that the couplings between said first and second pump sources and said first and second optical paths are such that a residual of said second pump radiation coupled into said first optical path has a power lower by 13 dB than said first pump radiation, and such that a residual of said first pump radiation coupled into said second optical path has a power lower by 13 dB than said second pump radiation.

11. A Raman amplifier (10) according to any one of claims 9 or 10, characterized in that said first minimum pump frequency and said first maximum pump frequency differ with each other of at most the 50% of said Raman shift, and said second minimum pump frequency and said second maximum pump frequency differ with each other of at most the 50% of said Raman shift.

12. A Raman amplifier (10) according to any one of claims 9 to 11, characterized in that said pump frequency range has a width of at least the 50% of said Raman shift.

13. A Raman amplifier (10) according to any one of claims 9 to 12, characterized in that said first and second group of frequencies do not overlap with each other.

14. A Raman amplifier (10) according to any one of claims 9 to 13, said first minimum and said first maximum pump frequencies defining a first pump frequency range and said second minimum and said second maximum pump frequencies defining a second pump frequency range, characterized in that at least one of said first and second pump frequency ranges has a width of at least the 20% of said Raman shift.

15. A Raman amplifier (10) according to any one of claims 9 to 14, characterized in that said first group of frequencies is adapted for Raman amplifying a first portion of said optical signal, said second group of wavelengths is adapted for

Raman amplifying a second portion of said optical signal, the first portion of optical signal having a greater attenuation versus wavelength in said Raman-active material than said second portion of optical signal.

16. A Raman amplifier (10) according to any one of claims 9 to 15, characterized in that said first and said second pump sources (13, 14) comprise a plurality of pump lasers, said plurality of pump lasers having an overall variation of pump power emission of at most the 50% of an average pump power emission.

17. An optical system comprising at least one optical line, said optical line including at least one optical fiber and at least one Raman amplifier (10) according to any one of claims 9 to 16, connected to said optical fiber.

18. An optical system according to claim 17, characterized in that it further comprises a transmitting station including a plurality of transmitters adapted for emitting a respective plurality of optical channels, each having a respective wavelength, said transmitting station being connected to a first end of said optical line.

19. An optical system according to claim 18, characterized in that it further comprises a receiving station including a plurality of receivers adapted to discriminate an information carried by said optical channels, said receiving station being connected to a second end of said optical line.